MARS' 1995 OPPOSITION FROM PIC DU MIDI. S. Erard, *I.A.S., bat.121, 91405 Orsay campus, France.* Erard@ias.fr.

Introduction and abstract. The last Martian apparition was observed from Pic-du-Midi between October 1994 and March 1995. Earth-based observation remains the only practicable way to perform continuous surveys of the planets, as opposed to orbital (HST) or space-borne observation. A good planetary site with limited demand for observational time like the 1-meter telescope at Pic-du-Midi provides the optimal opportunity to monitor planetary activity, including atmospheric phenomena, surface variations and polar caps recession. For instance, HST observations of Mars during this period although yielding a much better spatial resolution [1, 2], are limited to very few sessions and do not allow to monitor quick processes along a whole Martian season. Preliminary results regarding the recession of the north polar cap during springtime will be presented at the conference.

Observations. Mars was observed from October 1st, 1994 to March 13th, 1995 with the Pic-du-Midi 1-meter telescope (Station de planétologie des Pyrénées). Observations were performed using a Barlow lens and a set of large band and interferential filters. This period bracketed opposition with phase angles ranging from 38° to 22°. It corresponded to spring on Mars' northern hemisphere (Ls = 355° to 71°) when the polar hood dissipates and the cap becomes visible and recedes very quickly. Mars is then close to the aphely, so it appears very small as seen from the Earth. The best spatial resolution was achieved near opposition (February 11th), while the angular size of the disk was ~14" only. The seeing is estimated to 0.1" (usual at Pic-du-Midi), so all 130 pixels acquired on the disk are resolved; this corresponds to a resolution of about 100 km at the disk center (Fig. 1). Several hundreds of images were acquired on good observation nights.
The detector used during most of this period was a Thompson 384 x 288 CCD camera, cooled down to -103°C. The signal was digitized on 12 bits. At this temperature, dark current variations are on the order of 0.9 DN. The typical signal to noise ratio in I filter is about 500, with integration times ranging from 0.1 s (I filter) to 3 s (B filter). Flat fields were acquired at the end or at the beginning of each night, and various reference stars were observed during some of the nights only.

Equatorial regions. Surface variations and atmospheric activity at lower latitudes are best studied on Mercator projections of mosaic images. Only the central part of the disk is used (e, i < 60°). Disk images are corrected from limb darkening with a Minnaert function the exponent of which is fitted on the data (usually 0.8-0.9) and photometrically calibrated. Fig. 2 displays an example of such a map, acquired in the near-infrared where the contrast is larger. Accuracy of the projections is limited to a few degrees by the procedure used to determine the disk contour, and by uncertainty on the camera orientation in the focal plane.

Polar cap recession. A long series of observations like this one is particularly useful to study the recession of the polar caps with time. The north polar cap is always at the limb during this apparition, so its limits are studied with mosaics of several images. The same Minnaert exponent as above is used here. Although adapted to the Martian soils it is too low for the polar cap, which still appears darker than it really is. Depending on observing conditions, the mosaic is more or less complete in longitude. Fig. 3 shows two maps at different stages of recession; Fig. 3b compares very well with Fig.5 from [1], obtained with HST at Ls = 63.5°.
Whenever an overlap exists in longitude, the limit of the polar cap can be measured on photometrically calibrated mosaics as a function of the Solar longitude Ls. Recession curves will be computed from these images, and compared with previous measurements of the north polar cap from telescopic (e.g. [3-5]) and spatial observations [6-8]. Preliminary results imply that the recession curve is similar to that observed by Mariner 9 in 1972 [6], in accordance with [1].

References: [1] James *et al.*, *J.G.R.* 101, 18883-18890 (1996) [2] James *et al.*, *Icarus* 123, 87-100 (1996) [3] Iwasaki and Saito, *J.G.R.* 84, 8311-8316 (1979) [4] Iwasaki and Saito, *J.G.R.* 87, 10265-10269 (1982) [5] James *et al.*, *Icarus* 71, 306-312 (1987) [6] Soderblom *et al.*, *J.G.R.* 78, 4197-4210 (1973) [7] James, *Icarus* 52, 565-569 (1982) [8] Christensen and Zurek, *J.G.R.* 89, 4587-4596 (1984)

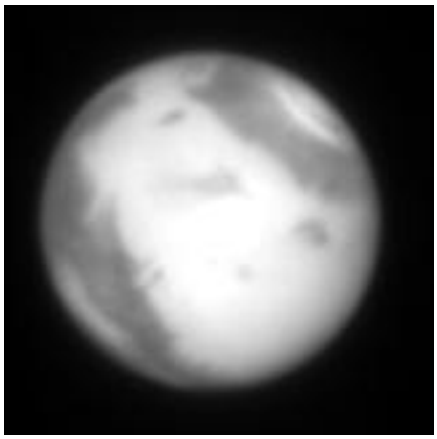


Fig.1: *example of raw image in I filter, with background subtracted. The north polar cap is in the upper right corner (orientation is arbitrary), Syrtis Major is the dark area at the western limb. Notice the dark ring inside the polar cap.*

Night	Angular size (")	L_S (°)	Phase angle (°)	Night	Angular size (")	L_S (°)	Phase angle (°)
Oct 01, 1994	5.94	355.55	37.4	Feb 01, 1995	13.61	53.02	9.5
Oct 02	5.97	356.06	37.4	Feb 02	13.65	53.46	8.8
Nov 19	7.84	19.45	37.9	Feb 03	13.69	53.90	8.0
Nov 20	7.89	19.92	37.9	Feb 04	13.73	54.34	7.2
Nov 21	7.95	20.40	37.8	Feb 05	13.76	54.78	6.5
Dec 06	8.91	27.38	35.9	Feb 06	13.79	55.22	5.7
Dec 08	9.05	28.30	35.6	Feb 09	13.85	56.54	3.7
Dec 10	9.20	29.22	35.2	Feb 10	13.86	56.98	3.2
Dec 11	9.28	29.68	35.0	Feb 20	13.70	61.36	7.0
Dec 12	9.35	30.14	34.7	Feb 22	13.62	62.24	8.6
Dec 13	9.43	30.60	34.5	Mar 09	12.57	68.79	19.2
Dec 15	9.59	31.52	34.1	Mar 11	12.40	69.66	20.4
Dec 16	9.67	31.97	33.8	Mar 13, 1995	12.22	70.54	21.6
Jan 31, 1995	13.56	52.58	10.3				

Table 1: *observational parameters for nights with good observational conditions.*

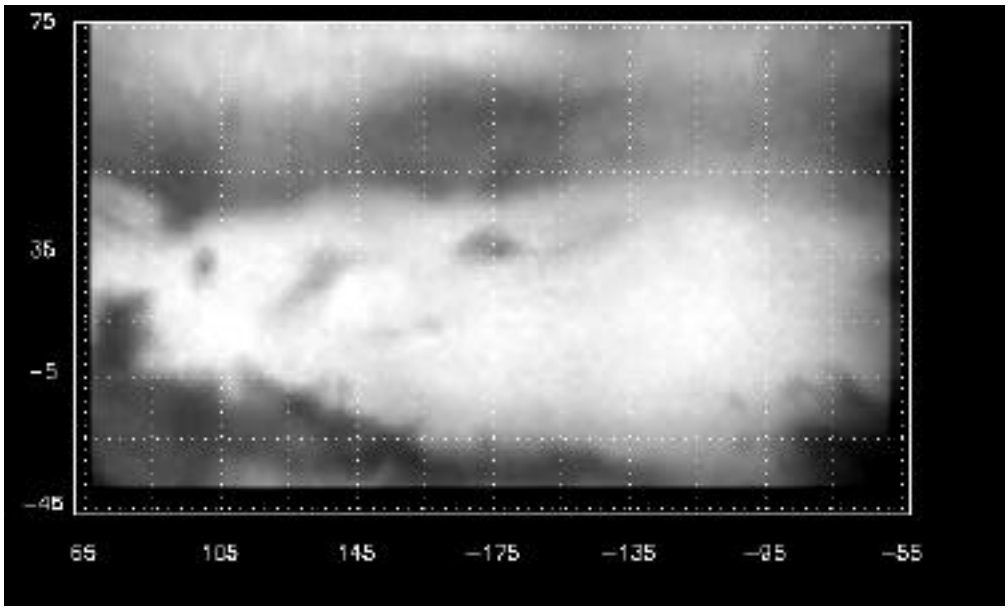
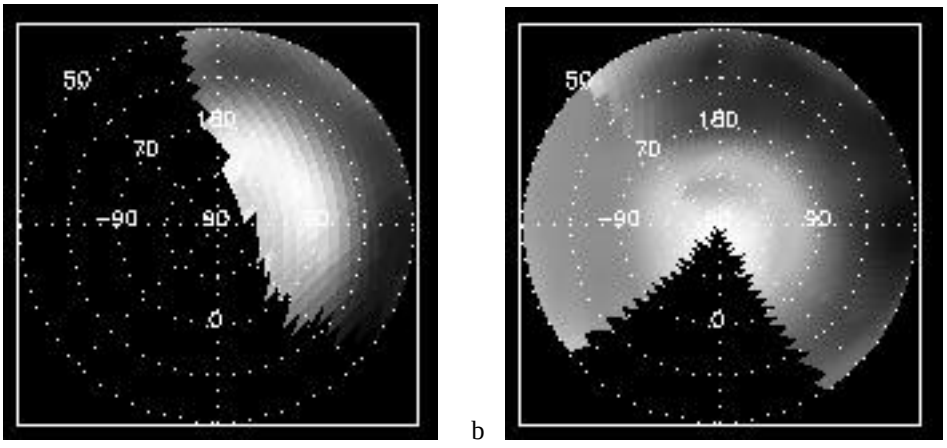


Fig.2: *Mercator projection of the equatorial regions (February 6th). This map is a mosaic of six images in I filter. Longitudes are plotted according to the terrestrial convention in these preliminary versions.*



a b

Fig.3: *two examples of Lambert's equal areas polar projections in I filter a) November 19th b) February 6th, when the cap has melted. The dark ring inside the cap is then very apparent.*